### SNOWFALL.

The *total monthly snowfall* at each station, if any occurs, is given in Tables I and II. The chart of geographical distribution is omitted for this month.

Light snow fell at a few points in Colorado and Wyoming on the 16th. Snow also fell at a few places in Montana on the 7th, 8th, 14th, and 15th; in Michigan at three stations on the 19th; in New York at one station on the 27th; at one station in Ohio on the 20th; in Utah at a few stations on the 23d, 28th, and 30th; in Idaho at one station on the 2d and 21st.

### HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 25. Arizona, 2, 9, 11, 23, 24, 25, 28, 29. California, 12, 25. Colorado, 11, 14, 16, 22, 25. Georgia, 1. Idaho, 3, 8, 11, 13, 28. Illinois, 1, 16. Indiana, 1, 16. Iowa, 1. Maine, 22. Michigan, 1. Missouri, 16. Montana, 8. Nebraska, 1, 5, 25. Nevada, 13, 25. New Jersey, 2, 13, 21. New Mexico, 15. New York, 26. North Carolina, 1. North Dakota, 6, 14. Ohio, 1, 16, 20. Oregon, 7. Pennsylvania, 13. South Dakota, 13. Utah, 10, 11. Washington, 7. Wisconsin, 19. Wyoming, 1, 26.

### SLEET.

Sleet was reported at Helena, Mont., on the 15th.

### WIND.

The *prevailing winds* for September, 1897, viz, those that were recorded most frequently, are shown in Table I for the regular Weather Bureau stations.

*Maximum wind velocities* are given in Table I, which also gives the altitudes of Weather Bureau anemometers above the ground. Maxima of 50 miles or more per hour were reported during this month as follows (maximum velocities are averages for five minutes; extreme velocities are gusts of shorter duration, and are not given in this table):

| Stations. | Date. | Velocity. | Direction. | Stations. | Date. | Velocity. | Direction. |
|---|---|---|---|---|---|---|---|
| | | *Miles* | | | | *Miles* | |
| Charleston, S. C | 21 | 50 | n. | Indianapolis, Ind | 1 | 66 | w. |
| Cleveland, Ohio | 1 | 59 | nw. | Do | 16 | 59 | w. |
| Do | 16 | 66 | nw. | Port Eads, La | 11 | 72 | ne. |
| Hatteras, N. C | 3 | 50 | nw. | Do | 12 | 60 | ne. |
| Idaho Falls, Idaho | 13 | 50 | sw. | Sandusky, Ohio | 16 | 52 | nw. |

The high velocities at Charleston and Port Eads occurred in connection with the passage of a West India hurricane; those at Cleveland, Sandusky, and Indianapolis were recorded during the prevalence of severe thunderstorms.

The winds were severe on Lake Erie on the afternoon of the 1st. Several small yachts were capsized; one life was lost, and a number of persons were in peril of their lives while the squall lasted.

The high velocity at Idaho Falls occurred with the shift of the wind from south to southwest about 2 p. m. of the 13th. The daily weather maps do not show pressure gradients over Idaho that would probably cause such a wind.

The *resultant winds*, as deduced from the personal observations made at 8 a. m. and 8 p. m., are given in Table VIII. These latter resultants are also shown graphically on Chart IV, where the small figure attached to each arrow shows the number of hours that this resultant prevailed, on the assumption that each of the morning and evening observations represents one hour's duration of a uniform wind of average velocity. These figures indicate the relative extent to which winds from different directions counterbalanced each other.

### ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IX, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

*Thunderstorms.*—The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 1st, 167; 2d, 119; 13th, 123; 16th, 259.

Reports were most numerous from Arizona and Ohio, 88; Colorado, 108; Florida, 121.

Thunderstorm days were most numerous in: Arizona, 27; Colorado, 25; Florida, 26; Utah, 23.

*In Canada.*—Thunderstorms were reported on the following dates: St. Johns, 1; Grand Manan, 9; Bermuda, 14; Yarmouth, 10, 27; Charlottetown, 14; Chatham, 10; Father Point, 9, 13; Quebec, 5, 9, 13; Montreal, 10, 13, 26; Toronto, 13; White River, 5, 15; Port Stanley, 1, 12, 16; Saugeen, 26; Port Arthur, 5, 6, 7; Winnipeg, 8; Minnedosa, 14, 27; Medicine Hat, 8, 14; Swift Current, 1, 28, 29; Prince Albert, 2; Battleford, 28.

*Auroras.*—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, from the 6th to the 14th, inclusive. On the remaining twenty-one days of this month 38 reports were received, or an average of about 2 per day. The dates on which the number of reports of auroras for the whole country especially exceeded this average were: 1st, 4th, 11th, 4; 22d, 11.

Reports were most numerous from Illinois, 5; Montana, 6; North Dakota, 10.

The number of reports was a large percentage of the number of observers in: Delaware, 33; North Dakota, 17; Montana, 6.

*In Canada.*—Auroras were reported on the following dates: Father Point, 6, 15, 22, 23, 24; Quebec, 3, 4, 5, 11, 22, 28; White River, 23; Minnedosa, 2, 5, 10, 12, 19, 22, 23, 28, 29, 30; Qu'Appelle, 22; Medicine Hat, 6, 25; Banff, 9; Prince Albert, 10, 11; Battleford, 20, 22.

### SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 21 regular stations of the Weather Bureau by its photographic, and at 41 by its thermal effects; at one of these stations records are kept by both methods. The photographic record sheets show the apparent solar time, but the thermometric records show seventy-fifth meridian time; for convenience the results are all given in Table X for each hour of local mean time. In order to complete the record of the duration of cloudiness these registers are supplemented by special personal observations of the state of the sky near the sun in the hours after sunrise and before sunset, and the cloudiness for these hours has been added as a correction to the instrumental records, whence there results a complete record of the duration of sunshine from sunrise to sunset.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table X for the 61 stations at which instrumental self-registers are maintained.

### COMPARISON OF DURATIONS AND AREAS.

The sunshine registers give the *durations* of effective sunshine whence the durations relative to possible sunshine are derived; the observers' personal estimates give the percentage of *area* of clear sky. These numbers have no necessary relation to each other, since stationary banks of clouds may obscure the sun without covering the sky, but when all clouds have a steady motion past the sun and are uniformly scattered over the sky, the percentages of duration and of area agree closely. For the sake of comparison, these percentages have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental records of percentages of durations of sunshine are almost always larger than the observers' personal estimates of percentages of area of clear sky; the average excess for September, 1897, is 8 per cent for photographic and 7 per cent for thermometric records.

The details are shown in the accompanying table, in which the stations are arranged according to the *total possible* duration of sunshine, and not according to the *observed* duration. In obtaining the total possible sunshine the value for the parallel of latitude nearest the station is used.

*Difference between instrumental and personal observations of sunshine.*

| Stations. | Latitude. | | Apparatus. | For whole month. | | Instrumental record of sunshine. | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Total possible. | Personal. | Photographic. | Difference. | Thermometric. | Difference. |
| | ° | ′ | | *H'rs.* | % | % | % | % | % |
| Key West, Fla | 24 | 34 | T. | 369.0 | 33 | ..... | ..... | 59 | +26 |
| Tampa, Fla | 27 | 57 | T. | 369.6 | 46 | ..... | ..... | 48 | + 2 |
| Galveston, Tex | 29 | 18 | P. | 370.4 | 72 | 78 | + 6 | ..... | ..... |
| New Orleans, La | 29 | 58 | T. | 370.8 | 58 | ..... | ..... | 57 | − 1 |
| Savannah, Ga | 32 | 05 | P. | 371.4 | 51 | 55 | + 4 | ..... | ..... |
| Vicksburg, Miss | 32 | 22 | T. | 371.4 | 73 | ..... | ..... | 77 | + 4 |
| San Diego, Cal | 32 | 43 | P. | 371.4 | 83 | 75 | − 8 | ..... | ..... |
| Charleston, S. C. | 32 | 47 | T. | 371.4 | 54 | ..... | ..... | 58 | + 4 |
| Phœnix, Ariz | 33 | 28 | P. | 371.4 | 66 | 82 | +16 | ..... | ..... |
| Atlanta, Ga | 33 | 45 | T. | 371.8 | 61 | ..... | ..... | 65 | + 4 |
| Los Angeles, Cal | 34 | 03 | P. | 371.8 | 65 | 78 | +13 | ..... | ..... |
| Wilmington, N. C.* | 34 | 14 | T. | ..... | ..... | ..... | ..... | ..... | ..... |
| Little Rock, Ark | 34 | 45 | T. | 372.0 | 74 | .... | ..... | 91 | +17 |
| Chattanooga, Tenn | 35 | 04 | T. | 372.0 | 66 | ..... | ..... | 76 | +10 |
| Santa Fe, N. Mex | 35 | 41 | P. | 372.2 | 49 | 63 | +14 | ..... | ..... |
| Raleigh, N. C. | 35 | 45 | T. | 372.2 | 69 | ..... | ..... | 83 | +14 |
| Nashville, Tenn | 36 | 10 | T. | 372.2 | 86 | ..... | ..... | 91 | + 5 |
| Fresno, Cal | 36 | 43 | T. | 372.6 | 85 | ..... | ..... | 91 | + 6 |
| Dodge City, Kans | 37 | 45 | P. | 373.0 | 73 | 86 | +13 | ..... | ..... |
| San Francisco, Cal | 37 | 48 | T. | 373.0 | 63 | ..... | ..... | 71 | + 8 |
| Louisville, Ky | 38 | 15 | T. | 373.0 | 84 | ..... | ..... | 93 | + 9 |
| St. Louis, Mo | 38 | 38 | T. | 373.4 | 86 | ..... | ..... | 90 | + 4 |
| Washington, D. C | 38 | 54 | P. | 373.4 | 73 | 79 | + 6 | ..... | ..... |
| Kansas City, Mo | 39 | 05 | P. | 373.4 | 80 | 84 | + 4 | ..... | ..... |
| Cincinnati, Ohio | 39 | 06 | T. | 373.4 | 80 | .... | .... | 82 | + 2 |
| Parkersburg, W. Va | 39 | 16 | T. | 373.4 | 77 | ..... | ..... | 86 | + 9 |
| Baltimore, Md | 39 | 18 | T. | 373.4 | 77 | ..... | ..... | 74 | − 3 |
| Atlantic City, N. J | 39 | 22 | P. | 373.4 | 67 | 80 | +13 | ..... | ..... |
| Denver, Colo | 39 | 45 | P. | 373.6 | 47 | 69 | +22 | ..... | ..... |
| Indianapolis, Ind | 39 | 46 | T. | 373.6 | 83 | ..... | ..... | 91 | + 9 |
| Philadelphia, Pa | 39 | 57 | T. | 373.6 | 62 | ..... | ..... | 77 | +15 |
| Columbus, Ohio | 39 | 58 | T. | 373.6 | 76 | ..... | ..... | 90 | +14 |
| Harrisburg, Pa | 40 | 16 | T. | 373.6 | 70 | ..... | ..... | 82 | +12 |
| Pittsburg, Pa | 40 | 32 | T. | 374.0 | 58 | ..... | ..... | 51 | − 7 |
| New York, N. Y | 40 | 43 | T. | 374.0 | 67 | ..... | ..... | 70 | + 3 |
| Salt Lake City, Utah | 40 | 46 | P. | ..... | 55 | ..... | ..... | ..... | ..... |
| Eureka, Cal | 40 | 48 | P. | 374.0 | 50 | 48 | − 2 | ..... | ..... |
| Cheyenne, Wyo | 41 | 08 | P. | ..... | 58 | ..... | ..... | ..... | ..... |
| Omaha, Nebr | 41 | 16 | P. | 374.0 | 79 | 87 | + 8 | ..... | ..... |
| Cleveland, Ohio | 41 | 30 | T. | 374.5 | 64 | ..... | ..... | 73 | + 9 |
| Des Moines, Iowa | 41 | 35 | T. | 374.5 | 80 | ..... | ..... | 83 | + 3 |
| Chicago, Ill | 41 | 53 | T. | 374.5 | 71 | ..... | ..... | 71 | 0 |
| Erie, Pa | 42 | 07 | T. | 374.5 | 59 | ..... | ..... | 72 | +13 |
| Binghamton, N. Y | 42 | 08 | T. | 374.5 | 61 | ..... | ..... | 67 | + 6 |
| Detroit, Mich | 42 | 20 | T. | 374.5 | 69 | ..... | ..... | 75 | + 6 |
| Boston, Mass | 42 | 21 | T. | 374.5 | 60 | ..... | ..... | 69 | + 9 |
| Dubuque, Iowa* | 42 | 30 | T. | ..... | ..... | ..... | ..... | ..... | ..... |
| Albany, N. Y | 42 | 39 | T. | 375.0 | 60 | ..... | ..... | 79 | +19 |
| Buffalo, N. Y | 42 | 53 | T. | 375.0 | 56 | ..... | ..... | 67 | +11 |
| Rochester, N. Y | 43 | 08 | T. | 375.0 | 52 | ..... | ..... | 54 | + 2 |
| Idaho Falls, Idaho | 43 | 29 | T. | 375.0 | 60 | ..... | ..... | 62 | + 2 |
| Portland, Me | 43 | 39 | T. | 375.4 | 58 | ..... | ..... | 75 | +17 |
| Northfield, Vt | 44 | 10 | P. | 375.4 | 47 | 54 | + 7 | ..... | ..... |
| Eastport, Me | 44 | 54 | P. | 375.8 | 33 | 54 | +21 | ..... | ..... |
| St. Paul, Minn | 44 | 58 | P. | 375.8 | 60 | 71 | +11 | ..... | ..... |
| Minneapolis, Minn | 44 | 59 | T. | 375.8 | ..... | ..... | ..... | 64 | ..... |
| Portland, Oreg | 45 | 32 | T. | 376.1 | 51 | ..... | ..... | 45 | − 6 |
| | 45 | 32 | P. | 376.1 | 51 | 48 | − 7 | ..... | ..... |
| Helena, Mont | 46 | 34 | P. | 376.9 | 67 | 69 | + 2 | ..... | ..... |
| Bismarck, N. Dak | 46 | 47 | P. | 376.9 | 73 | 78 | + 5 | ..... | ..... |
| Seattle, Wash | 47 | 38 | T. | 377.5 | 44 | ..... | ..... | 40 | − 4 |
| Spokane, Wash | 47 | 40 | P. | 377.5 | 50 | ..... | ..... | 56 | + 6 |

* Instrument out of order.

## CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective sections of the Climate and Crop Service. The name of the section director is given after each summary.

Snowfall and rainfall are expressed in inches.

*Alabama.*—The mean temperature was 75.6°, or 0.7° above normal; the highest was 102°, at Goodwater and Jasper on the 17th, and the lowest, 33°, at Hamilton on the 21st. The average precipitation was 0.55, or 2.15 below normal; the greatest monthly amount, 2.12, occurred at Mobile, while no rain fell at several stations.—*F. P. Chaffee.*

*Arizona.*—The mean temperature was 75.8°, or 2.2° above normal; the highest was 110°, at Maricopa, Parker, and Texas Hill on the 21st, 22d, 23d, and 24th, and the lowest, 37°, at Williams on the 16th. The average precipitation was 2.40, or 1.20 above normal; the greatest monthly amount, 7.10, occurred at Natural Bridge; no rain fell at San Simon.—*W. T. Blythe.*

*Arkansas.*—The mean temperature was 76.7°, or 3.8° above normal; the highest was 108°, at Keesees Ferry on the 3d, and the lowest, 33°, at Witts Springs on the 19th and at Newport on the 22d. The average precipitation was 0.60, or 2.46 below normal; the greatest monthly amount, 2.87, occurred at Fort Smith; no rain fell at several stations in the eastern portion of the State. The month was the driest September on record.—*F. H. Clarke.*

*California.*—The mean temperature was 67.7°, or 2.1° below normal; the highest was 117°, at Salton on the 24th, and the lowest, 10°, at Sneddens Ranch, Ventura County, on the 12th. The average precipitation was 0.33, or 0.11 above normal; the greatest monthly amount, 2.50, occurred at Crescent City Lighthouse; no rain fell in the upper San Joaquin Valley and in portions of southern California.—*W. H. Hammon.*

*Colorado.*—The mean temperature was 61.1°, or 3.7° above normal; the highest was 101°, at Las Animas and Wray on the 1st, and the lowest, 22°, at Millbrook on the 28th. The average precipitation was 1.31, or 0.27 above normal; the greatest monthly amount, 5.80, occurred at Rico, and the least, trace, at Yuma.—*F. H. Brandenburg.*

*Florida.*—The mean temperature was 77.2°, or 1.1° below normal; the highest was 99°, at Huntington on the 2d, and the lowest, 46°, at De Funiak Springs on the 21st. The average precipitation was 10.71, or 3.00 above normal; the greatest monthly amount, 23.01, occurred at Sebastian, and the least, 1.94, at De Funiak Springs.—*A. J. Mitchell.*

*Georgia.*—The mean temperature was 73.8°, or 1.3° above normal; the highest was 101°, at Washington on the 15th, and the lowest, 37°, at Cedartown on the 24th. The average precipitation was 2.83, or 1.31 below normal; the greatest monthly amount, 11.94, occurred at Brunswick; no rain fell at Canton, Gillsville, Rome, and Griffin.—*J. B. Marbury.*

*Idaho.*—The mean temperature was 57.8°; the highest was 95°, at Payette on the 21st, and the lowest, 17°, at Swan Valley on the 9th. The average precipitation was 1.10; the greatest monthly amount, 2.85, oc-